REMARKS

Claims 1-28 are pending in this application. By this Amendment, the specification and claims 1-4 and 22-28 are amended. Attached hereto is a marked-up version of the changes made to the specification and claims by the current amendment. The attachment is captioned **"Version with markings to show changes made."**

The Office Action rejects claims 3 and 4 under 35 U.S.C. §112, first paragraph, as containing subject matter which was not described in the specification. The Office Action asserts that there is a difference between a claimed equation and the equation in the specification. By this Amendment, the specification is amended on page 23 to include the "+" sign in equation (12). This is consistent with the original claim 3 and the corresponding equation (12) for u (x + w, y + w). See also equation 23 from the original Japanese-language application.

The Office Action also questions the support for an equation in claim 4. Support for claim 4 is provided in the English-language specification at least at page 24, lines 10-24. That is, claim 4 represents a process changing vertical and horizontal features. The characters L, P, B and T represent left, right, bottom and top, respectively. Claim 4 may be obtained by changing uL, vL, uR, vR, y and q in claim 3 to uT, vT, uB, vB, x and p, respectively. Thus, the application supports the equation in claim 4. These equations are also part of original claim 4, which therefore means the equations are supported by the original application. Withdrawal of the rejection under 35 U.S.C. §112, first paragraph, is respectively requested.

The Office Action rejects claims 1-28 under 35 U.S.C. §112, second paragraph. Applicants have amended each of the claims as suggested in the Office Action. It is respectfully submitted that the above amendments obviate the grounds for rejection. The Examiner is requested to contact applicant's undersigned attorney if any formal matters remain with respect to the claims. Withdrawal of the rejection under 35 U.S.C. §112, second paragraph, is respectfully requested.

The Office Action also rejects claims 1-28 under 35 U.S.C. §101 as being directed to non-statutory subject matter. In response to applicant's previous arguments, the Office Action suggests that claims 1 and 2 should be amended to include the language "to produce motion vectors" in the preambles. Applicants believe that the claims (prior to this Amendment) fully satisfy 35 U.S.C. §101 for the reasons set forth in that response. Upon review of the application and the Office Action's suggestion, applicants have amended the preamble of each of independent claims 1 and 2 to recite "for encoding/decoding image information". This amendment is more appropriate than the Office Action's suggestion since a predicted image may be obtained by use of motion vectors. Therefore, it does not seem appropriate to insert "to produce motion vectors" after "reference image". Applicants believe that the added language "for encoding/decoding image information" is proper. That is, independent claim 1 relates to a method of synthesizing an interframe predicted image of a current frame from a reference image for encoding/decoding image information. It clear that the body of claim 1 (and similarly the other claims) is positively linked to the preamble. The alleged "end product" as set forth in the Office Action is clearly satisfied by the "for
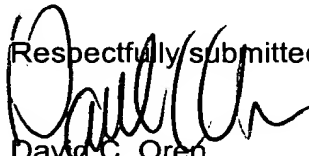
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encoding/decoding information". The respective features set forth in the claims relate to a useful, concrete and tangible result. As such, claims 1-28 comply with 35 U.S.C. §101. Withdrawal of the rejection under 35 U.S.C. §101 is respectfully requested.

The Office Action also does not reject any of the claims 1-28 based on the prior art of record. As such, it is believed that claims 1-28 define patentable subject matter.

CONCLUSION

In view of the foregoing, it is respectfully submitted that the application is in condition for allowance. Favorable consideration and prompt allowance of claims 1-28 is earnestly solicited.

Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, or credit any overpayment of fees, to the deposit account of Antonelli, Terry, Stout & Kraus, LLP, Deposit Account No. 01-2135 (520.37902X00).

Respectfully submitted,

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE SPECIFICATION:

The paragraph beginning on page 23, line 13 of the specification has been amended as follows:

--By performing another first order linear interpolation/extrapolation on the motion vectors (uL(y+w), vL(y+w)) and (uR(y+w), vR(y+w)) of the provisional representative points found as described above, (u(x+w, y+w), v(x+w, y+w)) which are the horizontal and vertical components of the motion vector of the pixel at (x+w, y+w)) multiplexed by m, are found. This processing is performed by the following equation:

$$u(x+w, y+w)=(((w_di+w_dp-w_dx-w_n)u_L(y+w)$$
$$+(w_dx+w_n-w_di)u_R(y+w))m)//(w_dpz)$$
$$v(x+w,y+w)=(((w_di+w_dp-w_dx-w_n)v_L(y+w)$$
$$\pm(w_dx+w_n-w_di)v_R(y+w))m)//(w_dpz)$$

.........(12)

IN THE CLAIMS:

Claims 1-4 and 22-28 have been amended as follows:

1. (Three Times Amended) A method of synthesizing an interframe predicted image of a current frame from a reference image for encoding/decoding image information comprising:

a first step for calculating the values of motion vectors between said

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interframe predicted image and said reference image for four representative points at coordinates (i,j), (i+p, j), (i, j+q), (i+p, j+q) of said interframe predicted image (where i, j, p, q are integers, the horizontal and vertical components of the motion vectors of the representative points taking the values of integral multiples of 1/k where k [and] is the hk power of 2, and hk is a non-negative integer),

a second step for calculating the motion vectors of a pixel in said interframe predicted image at coordinates (x+w, y+w) by performing bilinear interpolation/extrapolation on the motion vectors of the four representative points of an image where the pixel sampling interval in both horizontal and vertical directions is 1 and horizontal and vertical coordinates of sampling points are obtained by adding w to integers (where w=wn/wd, wn is a non-negative integer, wd is a hw power of 2, hw is a non-negative integer and wn<wd), where said second step comprises:

a third step for calculating the horizontal and vertical components of motion vectors at the coordinates (i, y+w) as numerical values which are respectively integral multiples of 1/z (where z is the power of 2, and hz is a non-negative integer) by linear interpolation/extrapolation of the motion vectors of the representative points at the coordinates (i, j), (i, j+q), and for calculating the horizontal and vertical components of the motion vectors at the coordinates (i+p, y+w) as values which are respectively integral multiples of 1/z (where z is the hz power of 2, and hz is a non-negative integer) by linear interpolation/extrapolation of the motion vectors of the representative points at coordinates (i+p, j), (i+p, j+q),

a fourth step for calculating the horizontal and vertical components of the

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motion vectors of the pixel at the coordinates (x+w, y+w) as values which are respectively integral multiples of 1/m (where m is the hm power of 2, and hm is a non-negative integer) found by linear interpolation/extrapolation of [the] two motion vectors at the coordinates (i, y+w), (i+p, y+w); and

a fifth step of calculating the pixel value of said pixel in said interframe predicted image of the coordinates (x+w, y+w) using said reference image and one of the motion [vector] vectors calculated in said fourth step.

2. (Three Times Amended) A method of synthesizing an interframe predicted image of a current frame from a reference image for encoding/decoding image information comprising:

a first step for calculating the values of motion vectors between said interframe predicted image and said reference image for four representative points at coordinates (i,j), (i+p, j), (i, j+q) (i+p, j+q) of said interframe predicted image (where i, j, p, q are integers, the horizontal and vertical components of the motion vectors of the representatives points taking the values of integral multiples of 1/k where k is the hk of power 2, and hk is a non-negative integer),

a second step for calculating the motion vectors of a pixel in said interframe predicted image at coordinates (x+w, y+w) by performing bilinear interpolation/extrapolation on the motion vectors of four representative points of an image where the pixel sampling interval in both horizontal and vertical directions is 1 and horizontal and vertical coordinates of sampling points are obtained by adding w to integers (where w=wn/wd, wn is a non-negative integer, wd is a hw power of 2, hw

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is a non-negative integer and wn<wd), where the second step comprises:

a third step for calculating the horizontal and vertical components of motion

vectors at the coordinates (x+w, j) as numerical values which are respectively

integral multiples of 1/z (where z is the hz power of 2, and hz is a non-negative

integer) by linear interpolation/extrapolation of the motion vectors of the

representative points at the coordinates (i, j), (i+p, j), and for calculating the

horizontal and vertical components of the motion vectors at the coordinates (x+w,

j+q) as values which are respectively integral multiples of [liz] 1/z (where z is the hz

power of 2, and hz is a non-negative integer) by linear interpolation/extrapolation of

the motion vectors of the representative points at coordinates (i, j+q), i+p, j+q),

a fourth step for calculating the horizontal and vertical components of the

motion vectors of the pixel at the coordinates (x+w, y+w) as values which are

respectively integral multiples of 1/m (where m is the hm of power 2, and hm is a

non-negative integer), found by linear interpolation/extrapolation of [the] two motion

vectors at the coordinates (x+w, j), (x+w, j+q); and

a fifth step of calculating the pixel value of said pixel in said interframe

predicted image of the coordinates (x+w, y+w) using said reference image and one

of the motion [vector] vectors calculated in said fourth step.

3. (Twice Amended) A method of synthesizing an interframe prediction

image according to Claim 1, wherein, when the motion vectors of a pixel at the

coordinates (x+w, y+w) are found using (u0, v0), (u1, v1), (u2, v2), (u3, v3), which

are the horizontal and vertical components of the motion vectors of the

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representative points at the coordinates (i,j), (i+p, j), (i, j+q), (i+p, j+q) multiplied by k,

(uL(y+w), vL(y+w)) which are the horizontal and vertical components of the motion

vectors at a point having the coordinates (i, y+w) multiplied by z, are found by

calculating:

$$uL\,(y+w) = (\,(\,(q{\cdot}wd - (y\text{-}j){\cdot}wd\text{-}$$
$$wn)\,u0 + ((y\text{-}j){\cdot}wd + wn)\,u2)z)////(q{\cdot}k{\cdot}wd),$$
$$vL(y+w)=(((q{\cdot}wd\text{-}(y\text{-}j){\cdot}wd\text{-}$$
$$wn)\,v0+((y\text{-}j){\cdot}wd+wn)\,v2)\,z)////(q{\cdot}k{\cdot}wd)$$

(where [[////]] _////_ is a division wherein the computation result is rounded to the

nearest integer when the result of an ordinary division is not an integer, and the

order of computational priority is equivalent to multiplication and division),

(uR(y+w), vR(y+w)) which are the horizontal and vertical components of the

motion vector at a point having the coordinates (i+p, y+w) multiplied by z, are found

by calculating:

$$[uR(y+w)=(((q{\cdot}wd\text{-}(y\text{-}j){\cdot}wd\text{-}$$
$$wn)\,u1 + ((y\text{-}j){\cdot}wd+wn)\,u3)\,z)\,////\,(q{\cdot}k{\cdot}wd)$$
$$vR\,(y+w)=(((q{\cdot}wd\text{-}(y\text{-}i){\cdot}wd\text{-}$$
$$wn)\,v1 + ((y\text{-}j){\cdot}wd+wn)v3)z)////(q{\cdot}k{\cdot}wd)]$$

$$\underline{uR(y+w)=(((q{\cdot}wd\text{-}(y\text{-}j){\cdot}wd\text{-}}$$
$$\underline{wn)\,u1 + ((y\text{-}j){\cdot}wd+wn)\,u3)\,z)\,////\,(q{\cdot}k{\cdot}wd)}$$
$$\underline{vR\,(y+w)=(((q{\cdot}wd\text{-}(y\text{-}j){\cdot}wd\text{-}}$$
$$\underline{wn)\,v1 + ((y\text{-}j){\cdot}wd+wn)v3)z)////(q{\cdot}k{\cdot}wd)}, \text{ and}$$

(u(x+w), y+w), v(x+w, y+w)) which are the horizontal and vertical components

of the motion vector of a pixel at the coordinates (x+w, y+w) multiplied by m, are

found by calculating:

$$u(x+w, y+w) = (((p \cdot wd-(x-i) \cdot wd-wn) \, uL \, (y+w)+((x-i) \cdot wd+wn) \, uR(y+w))m)//(p \cdot z \cdot wd)$$
$$v(x+w, y+w) = (((p \cdot wd-(x-i) \cdot wd-wn) \, vL \, (y+w) + ((x-i) \cdot wd+wn)vR \, (y+w))m)//(p \cdot z \cdot wd)$$

(where [[//]] // is a division wherein the computation result is rounded to the nearest integer when the result of an ordinary division is not an integer, and the order of priority is equivalent to multiplication and division).

4. (Three Times Amended) A method of synthesizing an interframe predicted image according to claim 2, wherein, when the motion vectors of a pixel at the coordinates (x+w, y+w) are found using (u0, v0), (u1, v1), (u2, v2), (u3, v3), which are the horizontal and vertical components of the motion vectors of the representative points at the coordinates (i, j), (i+p, j), (i, j+q), (i+p, j+q) multiplied by k,

(uT(x+w), vT(x+w)), which are the horizontal and vertical components of the motion vectors at a point having the coordinates (x+w, j) multiplied by z, are found by calculating:

$$uT(x+w) = (((p \cdot wd-(x-i) \cdot wd-wn) \, u0+((x-i) \cdot wd+wn)u1)z////(p \cdot k \cdot d),$$
$$vT \, (x+w) = (((p \cdot wd-(x-i) \cdot wd-wn) \, v0+((x-i) \cdot wd+wn)v1)z////(p \cdot k \cdot wd)$$

(where [[////]] //// is a division wherein the computation result is rounded to the nearest integer when the result of an ordinary division is not an integer, and the order of computational priority is equivalent to multiplication and division),

(uB(y+w), vB(y+w)) which are the horizontal and vertical components of the

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motion vectors at a point having the coordinates $(x+w, j+p)$ multiplied by z, are found by calculating:

$$uB(x+w)=(((p \cdot wd-(x-i) \cdot wd-wn)u2+((x-i) \cdot wd+wn)u3)z)////(p \cdot k \cdot wd),$$

$$vB(x+w)=(((p \cdot wd-(x-i) \cdot wd- wn)v2+((x-i) \cdot wd+wn)v3)z)////(p \cdot k \cdot wd), \text{ and}$$

$(u(x+w), y+w), v(x+w, y+w))$ which are the horizontal and vertical components of the motion vectors of a pixel at the coordinates $(x+w, y+w)$ multiplied by m, are found by calculating:

$$u (x+w, y+w)=(((q \cdot wd-(y-j) \cdot wd-wn)uT(x+w)+((y -j) \cdot wd+wn)uB(x+w))m)//(q \cdot z \cdot wd)$$
$$v(x+w, y+w)+(((q \cdot wd-(y-j) \cdot wd- wn)vT(x+w)+ ((y-j) \cdot wd+wn)vB(x+w))m)//q \cdot z \cdot wd)$$

(where [[//]] _//_ is a division wherein the computation result is rounded to the nearest integer when the result of an ordinary division is not an integer, and the order of priority is equivalent to multiplication and by division).

22. (Three Times Amended) A method of synthesizing an interframe predicted images according to Claim 1, wherein,

when the number of pixels in the horizontal and vertical directions of the image is respectively r and s (wherein r and s are positive integers), and the pixels of the image lie in a range wherein the horizontal coordinate is from 0 to less than r and the vertical coordinate is from 0 to less than s, (u0, v0), (u1, v1), (u2, v2), (u3, v3) which is expressed by

$$[u'(x, y)=(((s \cdot cd-cn-y \cdot cd)((r \cdot cd-cn-x \cdot cd)u00 + (x \cdot cd+cn)u01 +$$
$$(y \cdot cd+cn)((r \cdot cd-cn-x \cdot cd)u02+(x \cdot cd-cn)u03))k)///(r \cdot s \cdot n \cdot cd)]$$
$$\underline{u'(x, y)=(((s \cdot cd-cn-y \cdot cd)((r \cdot cd-cn-x \cdot cd)u00 + (x \cdot cd+cn)u01 +}$$
$$\underline{(y \cdot cd+cn)((r \cdot cd-cn-x \cdot cd)u02+(x \cdot cd-cn)u03))k)///(r \cdot s \cdot n \cdot cd^2)},$$
$$[v'(x, y)=(((s \cdot cd-cn-y \cdot cd)((r \cdot cd-cn-x \cdot cd)v00 +(x \cdot cd+cn)v01)+$$
$$(y \cdot cd+cn)((r \cdot cd-cn-x \cdot cd)v02+(x \cdot cd+cn)v03))k)///(r \cdot s \cdot n \cdot cd)]$$
$$\underline{v'(x, y)=(((s \cdot cd-cn-y \cdot cd)((r \cdot cd-cn-x \cdot cd)v00 +(x \cdot cd+cn)v01)+}$$
$$\underline{(y \cdot cd+cn)((r \cdot cd-cn-x \cdot cd)v02+(x \cdot cd+cn)v03))k)///(r \cdot s \cdot n \cdot cd^2)},$$

$$u0=u'(i, j)$$
$$v0=v'(i, j)$$
$$u1=u'(i+p, j)$$
$$[t1=v'(i+p, j)] \underline{v1=v'(i+p,j)}$$
$$u2=u'(i, j+q)$$
$$[u2=v'(i, j+q)] \underline{v2=v'(i,j+q)}$$
$$u3=u'(i+p, j+q)$$
$$[u3=v'(i+p, j+q)] \underline{v3=v'(i+p,j+q)}$$

(where $\underline{///}$ is a division wherein the computation result is rounded to the nearest

integer when the result of an ordinary division is not an integer, and the order of

priority is equivalent to multiplication and division), are used as the k times horizontal

and vertical components of motion vectors of representative points (i,j), (j+p, j), (i,

j+q), (i+p, j+q), by using (u00, v00), (u01, v01), (u02, v02), (u03, v03) (where u00,

v00, u01, v01, u02, v02, u03, v03 are integers), which are n times (where n is a

positive integer) motion vectors at the corners of an image situated at the coordinates

(-c, -c), (r-c, -c), (-c, s-c), (r-c, s-c) (where c=cn/cd, cn is a non-negative integer, cd is

a positive integer and cn<cd), whereof the horizontal and vertical components take

the values of integral multiples of 1/n.

23. (Twice Amended) An image encoding method using a method of

synthesizing an interframe predicted image underline according to claim 1 comprising:

a first step for synthesizing [an] the interframe predicted image by performing

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motion compensation using a decoded image of a previously encoded frame and an input image of current frame,

a second step for generating a differential image between said interframe predicted image and said input image of said current frame,

a third step for transforming said differential image to obtain a transformed signal which is then encoded,

a fourth step for applying an inverse transformation to said transformed signal to produce a decoded differential image and

a fifth step for generating a decoded image of said current frame by adding said decoded differential image and said

interframe predicted image[, wherein said fifth step is performed by an interframe predicted image synthesis method according to Claim 1].

24. (Twice Amended) An image encoding method using a method of synthesizing an interframe predicted image according to claim 22 comprising:

a first step for synthesizing [an] the interframe predicted image by performing motion compensation using a decoded image of a previously encoded frame and an input image of current frame,

a second step for generating a differential image between said interframe predicted image and said input image of said current frame

a third step for transforming said differential image to obtain a transformed signal which is then encoded,

a fourth step for inverse transforming said transformed signal to obtain a

decoded differential image, and

a fifth step for synthesizing a decoded image of a current frame by adding

said decoded differential image and said interframe predicted image [wherein,

said first step is performed by an interframe predicted image method as

defined in claim 22], and

said first step comprises a step for detecting and encoding information

relating to [said] motion vectors at the corners of an image.

25. (Twice Amended) An image coding method according to Claim 23,

wherein [the] representative points [in said fifth step are] comprise the corners of the

image.

26. (Twice Amended) An image decoding method using a method of

synthesizing an interframe predicted image according to claim 1, comprising:

a first step for inputting an interframe coding signal of an image frame which

is to be decoded and motion vector information concerning said image frame,

a second step for transforming said interframe coding signal into a decoded

differential signal,

a third step for producing an interframe predicted image from a decoded

image signal of another image frame different in time from said image frame to be

decoded and said motion vector information, and

a fourth step for adding the decoded differential signal and said interframe

predicted image [signal] to obtain a decoded image signal of said image frame which

is to be decoded[, wherein

said third step is performed by an interframe predicted image synthesis

method according to Claim 1].

27. (Twice Amended) An image decoding method according to Claim 26,

wherein [said] plural representative points [are the] comprise corner points of [said]

an image used by reproducing information relating to the motion vectors of the

representative points directly encoded as encoded data.

28. (Twice Amended) An image decoding method according to Claim 26,

wherein [said] plural representative points [are the] comprise corner points of [said]

an image.